AMENDMENTS TO THE DRAWINGS

Enclosed are marked-up copy and replacement drawings.

Attachment: Replacement sheets

Annotated sheets showing changes

REMARKS

Favorable consideration of this application as presently amended an in light of the following discussion is respectfully requested.

Claims 19-36 are pending in the present application.

This Preliminary Amendment cancels claims 1-18 and adds new claims 19-36, which are similar to claims 1-18 but have been drafted to better correspond with U.S. claims drafting practice. Also enclosed is a substitute specification correcting minor informalities and placing the specification in accordance with U.S. patent practice. A new abstract is also appropriately added. The drawings have also been amended to correspond with changes made in the specification. Applicant submits no new matter has been added.

Accordingly, an action on the merits is earnestly solicited.

Should there be any outstanding matters that need to be resolved in the present application, the Examiner is respectfully requested to contact David A. Bilodeau (Reg. No. 42,325) at the telephone number of the undersigned below, to conduct an interview in an effort to expedite prosecution in connection with the present application.

If necessary, the Commissioner is hereby authorized in this, concurrent, and future replies to charge payment or credit any overpayment to Deposit Account No. 02-2448 for any additional fees required under 37.C.F.R. §§1.16 or 1.14; particularly, extension of time fees.

Dated: February 13, 2006

Respectfully submitted,

By ____________

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Die Head for an Extruder

BACKGROUND OF THE INVENTION

Field of the Invention

[0001] The present invention is related ~~directed~~ to a die head for an extruder **including** ~~comprising~~ an outer shell, an inner cylindrical mandrel, an annular die gap located at discharge **side of the die head,** ~~side,~~ an intake opening located at an intake side **of the die head** for **receiving a** ~~the~~ melted mass, **and** at least one **rotatable** distribution element for distributing the melted mass in a central ring channel merging into the die gap.

Description of the Background Art

[0002] ~~From~~ DE **Patent publication No.** 199 23 973 **A1 illustrates** ~~A1,~~ a **known** die head for an **extruder. In more detail, this DE publication illustrates a die head including** ~~extruder is known, which essentially is comprised of~~ an outer shell and an inner cylindrical mandrel. The **outer** shell **and** ~~as well as~~ the mandrel are formed of segments, **in which** each **segment has** ~~having~~ insert members for routing **an** ~~the~~ inflowing melted mass from **an** ~~the~~ intake side through a central ring **channel. The central ring channel then** ~~channel, which~~ merges into a die gap on a discharge side of the die head. **Further, inside** ~~Inside~~ the die head, the melted mass is ~~essentially~~ spirally guided before it **exits,** ~~terminates,~~ under pressure, in an axial direction through **the** ~~a~~ die gap. **However, the extruded melted mass generally includes joint lines and flow marks caused by the melted mass being guided through the die head.**

SUMMARY OF THE INVENTION

[0003] **Accordingly, one object of the present invention** ~~It~~ is **to address** the **above-noted and other problems.**

[0004] **Another** object of the present invention **is** to **provide** ~~further develop~~ a die head for an extruder ~~such~~ that **extrudes** ~~it provides~~ a ~~more~~ homogeneous melted mass ~~as well as an extrudate~~ that is free of joint lines and flow marks.

[0005] To **achieve these and other advantages and in accordance with the purpose of the present invention, as embodied and broadly described herein,** ~~meet this objective,~~ the **present** invention **provides a die head for an extruder including an outer shell, an inner cylindrical mandrel, an annular die gap at a discharge side of the die head, at least one intake opening for receiving a melted mass, at least one distribution element for distributing the melted mass to a central ring channel terminating in the die gap, an inflow channel connecting the at least one intake opening to** ~~with~~ the **at least one distribution element. Further, at least one** ~~preamble~~ of ~~patent claim 1 is characterized in that~~ the distribution element **and the** ~~and/or an~~ inflow channel are formed such that ~~due to~~ the ~~inflowing melted mass, the~~ distribution element is set into torsional motion around **a** ~~the~~ longitudinal axis of the **mandrel due to a flow of the melted mass,** ~~mandrel,~~ and the flow of melted mass is routed to the

central ring channel.

[0006] Thus, ~~The particular benefit of~~ the present invention is particularly advantageous in that a more homogeneous melted mass is provided as well as extrudates that are free of joint lines, whereby an intensive agitation of the melt takes place. Further, the present inventor advantageously determined ~~Surprisingly, it was found~~ that a distribution element could be set into torsional motion via ~~by~~ the melted mass flowing tangentially to its periphery due to the viscous drag effect of the melted mass sticking to the walls of the distribution element.

In addition, ~~a further embodiment of the invention,~~ the distribution element may have an ~~can be of~~ annular shape or a ~~shape. However,~~ polygonal shape, ~~shapes can also be employed,~~ which preferably has ~~have~~ a peripheral surface that resembles a ring.

[0007] Further, ~~Preferably,~~ a thrust force resulting from the material expansion of the melted mass after emerging from ~~the~~ orifices of the distribution element is advantageously utilized to support the outer drag moment during the rotation of the distribution element. In addition, inside ~~Inside~~ the inner circular ring segment, ~~the~~ individual flows of melted mass, which are divided by orifices, are positioned on top of each other in a radial direction as a result of the rotation of the distribution element, and are routed inside the central ring channel to the die gap.

[0008] Also, ~~In a further embodiment of the invention,~~ the distribution element includes a plurality of lamellae with interspersed orifices, which are arranged at a slant such that the forces resulting from the material expansion at the orifice exits ~~facing the inner annular segment~~ generate a thrust moment. Thus, the ~~The~~ outer drag moment and the inner thrust moment ~~add up~~ favorably increase ~~to~~ a total torsional moment of ~~moment. Beneficially,~~ the distribution element. That is, a required torque can be generated in this way to overcome ~~the~~ friction resistances and to set the distribution element into rotation, namely, around a ~~the~~ symmetrical axis of the mandrel.

[0009] In addition, ~~a further embodiment of the invention,~~ at least one inflow channel extends ~~extents~~ in a tangential direction along a peripheral segment of the distribution element. Thus, due ~~Due~~ to the tangential inflow of the melted mass (particularly ~~mass, particularly~~ of the partial melt flows) ~~flows,~~ to the distribution element, a drive torque for rotating the distribution ~~circular ring~~ element can be advantageously ~~beneficially~~ generated.

[0010] Further, ~~In a further embodiment of the invention,~~ an inflow channel engages with an outer peripheral segment of the distribution element so that as large a peripheral surface (effective area) of the distribution element as possible is affected by the tangentially-oriented flow of melted mass. Also, one ~~One~~ end of

the inflow channel extends ~~thereby~~ within a close proximity to the outer periphery of the distribution element.
In addition, a ~~further embodiment of the invention, the~~ height of the inflow channels may ~~can~~ be set equal to a ~~the~~ height of the distribution element. However, ~~element; however,~~ it is preferable ~~preferred~~ that the height of the inflow channel increases along the tangential course of the inflow channels. In this way, a flow direction that is tangential to the periphery of the distribution element is ~~can be~~ achieved.

[0011] Further, ~~In a further embodiment of~~ the ~~invention, the~~ outer periphery of the distribution element is also engaged by at least one inflow channel. In addition, the ~~The~~ lamellae of the distribution element are arranged such that the melted mass flowing tangentially to an outer ~~the rotor~~ periphery (thereby ~~thereby~~ forming an obtuse angle) ~~angle~~ passes from the outer periphery of the distribution element into an area inside the distribution element, subsequently to be routed via an inner annular segment to a central ring channel.

[0012] In addition, ~~a further embodiment of~~ the outer ~~invention, the~~ shell is formed in segments, and the ~~whereby~~ shell segments and distribution elements are stacked on top of each other. In this manner, ~~a~~ coextrusion ~~in particular~~ can be generated. Alternatively, the shell segments can be separate ~~in order~~ to beneficially move the pre-distribution ~~pre-distribution~~ of the melted mass to ~~the~~ separation planes of the shell segments. In this manner, the tool-related part of the melt infeed required for the coextrusion can be realized in a beneficial manner.

BRIEF DESCRIPTION OF THE DRAWINGS

[0013] The present invention will become more fully understood from the ~~A~~ detailed description ~~of one embodiment is~~ given hereinbelow and the accompanying drawings which are given ~~illustrated~~ by way of illustration only, and thus, are not limited of the present invention, and ~~drawing,~~ wherein:

[0014] Fig. 1 is a longitudinal section of a die head in accordance with an embodiment of the present invention; ~~head;~~

[0015] Fig. 2 is a cross section of a die head in accordance with an embodiment of the present invention; ~~die head;~~

[0016] Fig. 3 is a partial longitudinal section of a die head in accordance with ~~according to~~ an alternative embodiment of the present invention; ~~embodiment;~~

[0017] Fig. 4 is a top view of a distribution element included in a die head in accordance with an embodiment of the present invention;
~~distribution element;~~
[0018] Fig. 5 is a longitudinal section of the ~~a~~ distribution element in accordance

with the ~~according to a preferred~~ embodiment shown in Fig. 4; and

[0019] Fig. 6 is a longitudinal section of a die head in accordance with an alternative embodiment of the present invention.

DETAILED DESCRIPTION

[0020] Reference will now be made in detail ~~according~~ to the preferred embodiments of the present invention, examples of which are illustrated in the accompanying drawings. ~~a further alternative embodiment.~~

[0021] In more detail, and as shown in Fig. 1, the~~A~~ die head 1 in accordance with an embodiment ~~is essentially comprised~~ of the present invention includes an outer shell 2, ~~2 and~~ an inner cylindrical mandrel 4, and ~~4. Additionally, according to the invention,~~ a distribution element 6 ~~is~~ provided in an area between the outer shell 2 and the mandrel 4. Further, as shown in Fig. 2, the die head 1 includes ~~4, which around its periphery is surrounded by~~ inflow channels 16 (e.g., 161, 162, and 163) surrounding a periphery of ~~16.~~

~~Particularly for forming multilayered tubes, but also for~~ the mandrel 4, and ~~sheathing of string-shaped semi-finished products,~~ at least one intake opening 15 ~~for the melt flows to be distributed are~~ arranged on an ~~the~~ exterior shell surface of the die head 1 for receiving a melt flow. ~~head.~~

[0022] In addition, as shown in Fig. 1, ~~the instant exemplary embodiment,~~ the die head 1 is segmented in an axial direction and includes ~~is comprised of~~ a plurality of shell segments 2', each ~~of which~~ having a dedicated distribution element 6. Further, the ~~The~~ die head 1 is particularly suited for forming a coextrusion, which is a process of extruding two or more materials. Also, as ~~coextrusion. As~~ can be seen in Fig. 1, each ~~of the~~ shell segment ~~segments~~ 2' has intake openings 15, from which inflow channels 16 extend in a ~~the~~ direction of the distribution element 6 (see also Fig. 2). As shown in Figs. 1 and 2, after ~~6. After~~ a melt flow (e.g., ~~flow, that is,~~ partial melt flows 8, 8', and 8") ~~8",~~ pass through ~~the~~ orifices 7 included in ~~of~~ the distribution element 6, the partial flows ~~they~~ are routed along a central ring channel 17 and along the mandrel 4 to a die gap 19 arranged on a ~~an~~ discharge side 18 of the die head 1.

[0023] Further, as shown in Fig. 1, the die head 1 also includes cover plates 3 on ~~18. On~~ the discharge side 18 as well as on an intake side 20 of the die head 1. The ~~1,~~ cover plates 3 ~~are provided, which~~ press together the shell segments 2' so as to secure ~~together, that is, with which~~ the shell segments 2' using bolts, for example. ~~are bolted together.~~ In addition, as shown in Figs. 1 and 2, in a first shell segment 2' facing the intake side 20 of the die head 1, ~~20,~~ a first melt flow 8 ~~8'~~ of a first synthetic material is conveyed to the central ring channel 17, and in a ~~17. In the~~ subsequent shell segment 2' in the direction of the flow, a second synthetic material 8' ~~the plastic melt 8"~~ of a different material is feed ~~feed,~~ via an intake opening 15 (see in particular Fig. 2) ~~(not shown)~~ arranged laterally to

the die head 1 and peripherally adjacent to the first plastic melt 8 ~~8',~~ through the central ring channel 17. Additional shell segments 2' and/or distribution elements 6 can follow in the direction of the mandrel 4, whereby laterally ~~laterally,~~ further melt flows (e.g., melt flow 8" in Fig. 2) of identical or different material can be introduced.

[0024] In addition, ~~To produce a homogeneous melt~~ – as shown ~~can be better seen~~ in Fig. 2, the ~~2~~ – ~~a~~ distribution element 6 ~~is provided, which~~ extends at a radial distance from the mandrel 4. In the example shown ~~4~~ in Fig. ~~the area of an interior surface of the shell~~ 2, ~~that is, the shell segment 2'. Preferably,~~ the distribution element 6 has an annular arrangement ~~arrangement,~~ with a plurality of lamellae 11 interspersed with orifices 7. Further, the ~~The~~ lamellae 11 can be tapered towards the inside, and ~~inside. Preferably, the lamellae 11~~ are preferably pointed or rounded towards an ~~the~~ interior of the distribution element 6, whereby inert zones and ~~the~~ negative effects resulting from ~~therefrom, for example,~~ long dwelling times, swirling etc. are avoided. Also, ~~The~~ surfaces of the lamellae 11 forming the orifices 7 may have a ~~can thereby be~~ planar or convex shape. A ~~convex-shaped. The~~ cross section of the orifices 7 may also be ~~can~~ narrow in the direction of the flow, or may ~~can~~ remain constant. Further, a ~~A~~ base area ~~71~~ of the orifices 7 may have a ~~can be~~ planar shape, ~~or can~~ have a radius, and/or ~~can~~ be horizontal or tilted towards the inner periphery of the distribution element 6.

[0025] In addition, ~~As can be seen in~~ Fig. 2 illustrates ~~2,~~ three inflow channels 161, 162, and 163 ~~16 are~~ dedicated to the distribution element 6 such that respective viscous flows 81 are formed to extend ~~extending~~ tangentially to a ~~the~~ peripheral surface 21 of the ~~a~~ distribution element 6. That is, the ~~21. The~~ inflow channel 161, 162, and 163 extend so as to engage ~~16 extends such that it engages~~ the peripheral surface ~~segment~~ 21 of the distribution element 6. In one ~~the instant exemplary~~ embodiment, the peripheral surface ~~segment~~ 21 engaged by a respective ~~the~~ inflow channel ~~16~~ covers an angle of about 120 degrees. Further, as shown in Fig. 2, the ~~The~~ inflow channel 161, 162, and 163 narrow ~~16 narrows~~ in a radial direction in the area of the peripheral surface ~~segment~~ 21 of the distribution element 6 until an ~~the~~ end portion 22 of a respective ~~the~~ inflow channel ~~16~~ reaches a ~~the~~ vicinity of the outer periphery of the distribution element 6 ~~6,~~ without touching the ~~said~~ outer periphery.

[0026] Also, the ~~The~~ end portions 22 of the inflow channels 161, 162, and 163 extend ~~channel 16 extends~~ within close proximity to a succeeding inflow channel. Thus, a dragging ~~channel 16`. In this way, the drag~~ effect of the flow of a melted mass 81 extending tangentially to the distribution element 6 is transmitted to a maximum portion of the peripheral surface 21 of the distribution element 6, whereby the dragging ~~drag~~ moment generated at the periphery of the distribution element 21 caused by the wall-adhering melt flow 81 is maximized. In addition, a more homogeneous supply of the partial melt flows 8, 8' and 8" ~~flow 8~~ to the outer peripheral area of the distribution element 6 is assured.

[0027] In addition, with reference to Figs. 1 and 2, a~~The~~ maximum height H of the inflow channel 16 is ~~16, which~~ preferably ~~is~~ reached at the end portion 22 of the inflow channel 16 and ~~16,~~ corresponds to a ~~the~~ height H of the distribution element 6. That is, a ~~Preferably, the~~ height h of the inflow channel ~~channel,~~ starting at an ~~the~~ inflow point 161 of the inflow channel 16 ~~16,~~ increases to the height H of the distribution element 6 at the end portion 22 of the inflow channel 16. Thus, because of a ~~Due to the~~ steady expansion from the ~~an~~ initial height h ~~of the inflow channel all the way~~ to the height H ~~of the inflow channel~~ at the end portion 22 of the inflow channel 16, the viscous flow 81 used ~~required for the rotation of the distribution element 6, which causes drag moments and extends tangentially~~ to rotate the ~~peripheral segment 21 of the~~ distribution element 6 ~~6,~~ is advantageously intensified, ~~beneficially intensified on the one hand,~~ and thus ~~on the other hand,~~ a particularly homogeneous distribution of the melted mass is achieved. Further, an ~~The~~ inner shell surface below and/or above the inflow channel 16 extending close to the distribution element 6 ~~6,~~ is preferably tilted and/or rounded, whereby ~~an optimization in regard to~~ inert zones are advantageously avoided. ~~to be avoided is achieved in a beneficial manner.~~

[0028] Also, with reference to Fig. 4, the~~The~~ lamellae 11 of the distribution element 6 are tilted in a ~~the~~ same way such that partial melt flows 23 are rerouted from a respective ~~the~~ inflow channel 16 through the orifices 7 into an ~~the~~ inner cavity 24 (see Fig. 2) of the die head 1, thereby passing over an obtuse angle ß. By arranging the orifices 7 in this way, a ~~the~~ force action generated at an ~~the~~ orifice exit 72 (see Fig. 5) by the expansion of the melted mass is utilized with a lever arm 80 according to Fig. 4 to generate a thrust moment, which rotates ~~supports~~ the ~~rotation of the~~ distribution element 6 in a direction 25 around the longitudinal axis of the mandrel 4. In addition, a ~~A~~ drive torque is generated by the drag effect of the wall-adhering melted mass, which is caused by the melt flow of the inflow channels 16 extending tangentially to the periphery of the distribution element 6.

[0029] Further, with reference to Figs. 4 and 5, a~~The~~ base area 71 of the orifices 7 may ~~according to Figs. 4 and 5 can~~ be planar or have a radius, and in its extension from an ~~the~~ outer to the inner radius of the distribution element 6 may be formed as a circular ring, or may ~~can~~ be horizontal or tilted. Figs. 4 and 5 illustrate an ~~a preferred~~ embodiment of the distribution element 6 having the ~~a~~ base area 71 that is inclined such that an ~~the~~ entire interior area 61 of the distribution element 6 is utilized for the discharge of the orifices 7. In this way, the force action predominant at the orifice discharge 72 and generating the thrust factor, which positively aids the torsional motion of the distribution element 6, can be extended across the entire inner surface of the distribution element 6. At the same time, the inner shell surface of the distribution element 6, which generates the braking torque, can be reduced to a minimum. In addition, the

~~The~~ lamellae 11 may ~~can~~ be straight or curved and have a ~~curved. The lamellae 11 can be of~~ uniform shape in a ~~the~~ peripheral direction, or at regular intervals may have ~~intervals, can be of~~ different shapes.

[0030] Turning now to Fig. 3, which illustrates~~The melted mass can be a thermoplastic material, for example.~~

~~The distribution effect of the present invention can also be used for other free-flowing mediums.~~

~~In~~ an alternative embodiment of a die head 31 ~~according to Fig. 3~~ for coextrusion. As shown, the die head 31 includes ~~forming~~ a ~~coextrusion, a~~ shell segment 32 having ~~can have~~ a plurality of annular hollow chambers 34 extending in a radial plane 33 of ~~away from~~ the segment 32. ~~segment.~~ For example, Fig. 3 illustrates an outer hollow chamber 35, ~~35 can be provided, in~~ which includes a distribution element 36 having a relatively wide radius. Also shown is ~~radius extends. In a radial direction to the inside,~~ a first inner cavity 37 with a first inner distribution element 38 and an axially staggered second inner cavity 39 with a second inner distribution element 40. ~~40 extend.~~ The distribution elements 36, 38, 40 may have a similar shape as ~~can be shaped like~~ the distribution element 6 shown ~~of the embodiment~~ in Figs. 4 and 5.

[0031] Further, the~~The~~ plastic melt is fed into the outer hollow chamber 35 via an axial intake opening 41 and a subsequent intake channel 42. The corresponding intake channels of the other hollow chambers 37 and 39 extend in a similar rotation-symmetric ~~the same~~ fashion ~~rotation-symmetric~~ in a peripheral direction around the distribution ~~annular~~ elements 38, 40. However, the intake openings are arranged in a different peripheral area of the shell segment 32. Further, at ~~At~~ least one intake opening is dedicated to each of the hollow chambers 34, 37, 39 ~~39,~~ from which the intake channels 42 branch off symmetrically in relation to a ~~the~~ longitudinal center plane of the die head 31.

[0032] In addition, an ~~31, or rotation-symmetric. An~~ even supply of the plastic melt to the corresponding hollow chambers 34, 37, 39 assures ~~is necessary to assure~~ a self-centration of the distribution ~~annular~~ elements 36, 38, 40. In addition, the ~~The~~ pre-distribution of a melt flow, which is routed in sideways via an orifice arranged at the peripheral area of the shell segment 32, can be accomplished, ~~done,~~ for example, with multi-pronged distributors, center-sleeve distributors etc. Also, the

~~The~~ distribution element is formed as a circular ring element having radial orifices, and routes the flow of melted mass to an inner circular ring segment, where the flow of melted mass is routed in an axial direction inside the central ring channel to the die gap.

[0033] For a uniform ~~punctiform~~ merging of the plastic melt for coextrusion, a first discharge channel 43 ~~43, which~~ extends from a segment of the outer hollow chamber 35 ~~facing the inner side of the circular ring element 36~~ to an annular junction point 44. Also, a ~~44, is dedicated to the outer hollow chamber 35. A~~ second discharge channel 45 ~~45, which~~ extends from the inside of the first inner hollow chamber 37 and ~~37,~~ terminates at the ~~this~~ annular junction point 44, and a ~~44. A~~ third discharge channel 46 originating in the second inner hollow chamber 39 ~~also~~ terminates at the annular junction point 44 so that various plastic melts can be stacked on top of each other.

[0034] Thus, ~~Beneficially,~~ coextrusion can be advantageously performed ~~hereby done~~ in a space-saving manner because the hollow chambers 35, 37, 39 are ~~essentially~~ arranged in the ~~a~~ radial plane 33 of the die head 31. In the example in Fig. 3, the ~~33. The~~ hollow chambers 35, 37, 39 have an ~~are all of~~ annular shape and have ~~shape, each having~~ a single annular element 36, 38, 40 arranged inside. Further,

~~In~~ the ~~instant exemplary embodiment, the~~ die head 31 has the ~~a~~ mandrel 47 that increases in width axially in the direction of the orifice 41. Alternatively, ~~41, in which the inner hollow chambers 37 and 39 as well as their dedicated annular elements 38 and 40, and~~ the ~~discharge channels 45, 46 are arranged. As an alternative, the~~ mandrel 47 can be segmented.

[0035] Turning next to ~~In~~ a description ~~preferred embodiment~~ of the distribution element 6 with reference to ~~of~~ Figs. 4 and 5. As shown, ~~5,~~ the distribution element 6 functioning as a rotor is a circular ring element having a beveled inner ring surface 112. Further, ~~Thus,~~ the distribution element 6 includes the ~~has~~ lamellae 7, ~~107,~~ which widen radially towards the outside. The distribution element 6 is also conical in its cross section, and ~~section. The distribution element 6 can be~~ symmetrical to its longitudinal center plane 109. In addition, beveling ~~Beveling~~ results in a wider distribution of individual flows of melted mass 110 (see in particular Fig. 4), ~~110,~~ preferably in a radial and/or axial direction. Also, before ~~Before~~ reaching the inner ring surface 112 of the distribution element 6, the individual flows 110 of melted mass leave a channel 111 of the distribution element 6 and ~~6. The individual flows of melted mass 110~~ are thereby separated in an axial and/or radial direction.

[0036] Thus, the emerging individual flows of the melted mass 110 are ~~can be~~ wider in a radial and axial direction, therefore being more effective. In this manner, the ~~effect of~~ joint lines can be removed ~~line obliteration~~ and homogeneous material may ~~homogenization resulting from the rotor torsion can~~ be produced. ~~reinforced.~~ Additionally, pressure ~~the~~ loss ~~of pressure~~ in the distribution element 6 is substantially reduced resulting in ~~reduced. The result is~~ a multi-layer melt flow medley. Further, because of a ~~Due to~~ low resistance, the speed of the individual melt flows 110 arranged at a distance to the center plane ~~line~~ 109 is greater than the speed of the individual melts 110 flowing along the base areas 71 of the orifices 7. In addition, the ~~orifices. The~~ lamellae 11 on

a first face side 150 and an opposite face side 151 of the distribution element 6 are staggered such that one lamella 107 ~~each~~ is positioned above **the** ~~an~~ orifice 7. Preferably, the lamellae 107 are tapered towards the interior of the distribution **element** ~~element,~~ or ~~else~~ are rounded. With **such** a design and array of the lamellae **107,** ~~107 such as this,~~ a considerable improvement of the properties of **a semi-finished** ~~the semi-finished~~ product with regard to a high quality of the extrudate can be achieved, for example, pipes and foils free of joint lines, **thereby improving** ~~improved~~ mechanical and optical properties of the extrudate.

[0037] In addition, the~~The~~ channels 111 **in Fig. 4 may** ~~can~~ be curved of **rounded, and in particular,** ~~rounded.~~ ~~Possible~~ sharp edges of the **channels** ~~channel~~ 111 **may** ~~can~~ be rounded. **Further, all** ~~All~~ surfaces of the distribution element 6 **may** ~~can~~ be cambered **surfaces, and a** ~~surfaces;~~ ~~the~~ strength of the ring **wall and a** ~~wall,~~ ~~the~~ diameter and height of the distribution element 6 **may** ~~can~~ be varied.

The wall strength, diameter and height of the distribution element 6, **which is** preferably a circular ring element, can be varied such that **a** ~~the~~ sum of the torques driving the distribution **element 6 including** ~~element,~~ ~~comprised~~ ~~of~~ the drag and thrust **moments** ~~moments,~~ is greater than the friction moments caused by the viscosity of the melt.

[0038] Turning next to Fig. 6, which illustrates another~~In~~ ~~an~~ ~~alternative~~ embodiment of **a** ~~the~~ die head 2032 ~~according to Fig. 6~~ for tube extrusion of thermally sensitive **melts such as PVC. As shown, the die head 2032 includes** ~~melts, for example, PVC,~~ a shell segment 201 **having** ~~can include~~ a displacement body 202, which on the side facing **a** ~~the~~ melt intake opening 203 is conical or torpedo-shaped. **Further, the** ~~The~~ displacement body 202 is supported by a cover plate 204 located opposite the intake opening 203. **Also included is an annular hollow chamber 206 extending** ~~Extending~~ along the side of the displacement body 202 facing **a** ~~the~~ nozzle discharge **205. The** ~~205 is an~~ annular hollow chamber **206 includes the** ~~206, wherein again a~~ distribution element 6 **shown in** ~~according to~~ Figs. 4 and **5. Further, because** ~~5 is arranged.~~ ~~Due to~~ a plurality of **melt-conveying** ~~melt-conveying~~ inflow channels 207 **have a** similar ~~in~~ design **as** ~~to~~ the inflow channels 16, ~~and the distribution element 6,~~ the drag and thrust moments resulting from the beneficially arranged melt routing are likewise utilized for the rotation of the distribution element 6.

[0039] In addition, the~~The~~ inflow of melted mass **may** ~~can~~ be conveyed to the distribution element **6** either from the outside and/or from the inside. **Further,** ~~An in~~ a radial direction exterior outer peripheral surface of the distribution element and/or an in a radial direction interior inner peripheral surface of the distribution element is thereby impacted by the melt.

[0040] Further, the melted mass may be a thermoplastic material, for example. The distribution effect of the present invention can also be used for

other free-flowing mediums. Thus, the die head of the present invention may be used to form multilayered tubes, and also for the sheathing of string-shaped semi-finished products.

[0041] The invention being thus described, it will be obvious that the same may be varied in many ways. Such variations are not to be regarded as a departure from the spirit and scope of the invention, and all such modifications as would be obvious to one skilled in the art are to be included within the scope of the following claims.

What is claimed is:~~Patent Claims:~~

1. A die~~Die~~ head for an extruder, comprising:
~~comprised of~~ an outer shell;
~~shell,~~ an inner cylindrical mandrel;
~~mandrel,~~ an annular die gap at a discharge side of the die head;
~~side,~~ at least one intake opening for receiving a ~~the~~ melted mass;
~~mass,~~ at least one distribution element for distributing the melted mass to a central ring channel terminating in the die gap;
an inflow channel connecting the at least one intake opening to the at least one distribution element,
wherein at least one of ~~gap, characterized in that~~ the distribution element and the ~~(6) and/or an~~ inflow channel ~~(16)~~ are formed such that the distribution element ~~(6)~~ is set into torsional motion around a ~~the~~ longitudinal axis of the mandrel ~~(4)~~ due to a flow of the ~~inflowing~~ melted mass, and ~~that~~ the flow of melted mass is routed to the central ring channel.

2. The die~~Die~~ head according to claim 1, wherein at least one of ~~characterized in that~~ the distribution element and the ~~(6) and/or an~~ inflow channel ~~(16)~~ are formed such that a tangential flow of the melted mass occurs on a peripheral surface of the distribution element. ~~element (6) occurs.~~

3. The die~~Die~~ head according to claim 1, wherein ~~1 or 2, characterized in that~~ the distribution element ~~(6)~~ includes a plurality of lamellae ~~(11)~~ interspersed with orifices such that an action of force occurs on the distribution element due to the flow of the melted mass.

4. The die~~Die~~ head according to claim ~~claims 1 to~~ 3, wherein ~~characterized in that~~ the orifices ~~(7)~~ are oriented such that an imaginary extension of a ~~the~~ direction of the ~~melt~~ flow of melted mass at an ~~the~~ exit of the orifice runs at a distance to a ~~the~~ centerline of the mandrel. ~~mandrel (4).~~

5. The die~~Die~~ head according to claim 3, wherein ~~one of claims 1 to 4, characterized in that~~ the orifices ~~(7)~~ are oriented such that the flow of melted mass is re-routed around an obtuse angle ~~(ß)~~ at an ~~the~~ entry of the orifices so that ~~the~~ drag and thrusting moments, which move in a ~~the~~ same rotational direction, ~~direction (25),~~ add up to a total torque setting the distribution element in motion. ~~torque.~~

6. The die~~Die~~ head according to claim 2, wherein ~~one of claims 1 to 5, characterized in that~~ at the peripheral surface of the distribution element where the tangential flow occurs, the distribution element ~~(6)~~ has a relatively large effective surface for transmitting a ~~the~~ force of the tangentially flow of ~~inflowing viscous~~ melted mass.

7. The die~~Die~~ head according to claim 1, wherein a ~~one of claims 1 to 6, characterized in that the~~ height ~~(h)~~ of the inflow channel ~~(16)~~ increases in a ~~the~~ flow direction of the melted mass.

8. The die~~Die~~ head according to claim 3, wherein ~~one of claims 1 to 7, characterized in that~~ the lamellae ~~(11)~~ are pointed or rounded in a ~~the~~ flow direction of the melted mass.

9. The die~~Die~~ head according to claim 1, wherein one ~~of claims 1 to 8, characterized in that one~~ end of a first inflow channel ~~(16)~~ is arranged close to a succeeding inflow channel. ~~channel (16`).~~

10. The die~~Die~~ head according to claim 1, wherein ~~one of claims 1 to 9, characterized in that in an inner ring surface (11),~~ the distribution element ~~(6)~~ is beveled and/or rounded at an inner ring surface thereof. ~~rounded.~~

11. The die~~Die~~ head according to claim 3, wherein ~~one of claims 1 to 10, characterized in that~~ the lamellae ~~(11)~~ and/or the orifices on opposing face sides ~~(150, 151)~~ of the distribution element ~~(6)~~ are respectively arranged in a staggered array.

12. The die~~Die~~ head according to claim 1, wherein ~~one of claims 1 to 11, characterized in that~~ the shell includes ~~(2) is formed by~~ a plurality of shell segments, ~~segments (2'),~~ each having a dedicated distribution element, ~~element (6),~~ and

wherein ~~that~~ the shell segments ~~(2')~~ are stacked on top of each other around the distribution elements, ~~elements (6),~~ and ~~that~~ each shell segment ~~(2')~~ has at least one dedicated inflow channel. ~~channel (16).~~

13. The die~~Die~~ head according to claim 1, wherein ~~one of claims 1 to 12, characterized in that~~ the distribution element ~~(36, 38, 40)~~ is arranged in an annular hollow space within the outer shell. ~~(34, 35, 37, 39).~~

14. The die~~Die~~ head according to claim 1, wherein ~~one of claims 1 to 13, characterized in that~~ the distribution element ~~(6)~~ is a circular ring element.

15. The die~~Die~~ head according to claim 1, wherein ~~one of claims 1 to 14, characterized in that~~ the distribution element ~~(6)~~ is arranged in a torpedo-shaped or conical displacement body, ~~body (202),~~ whereby the melted mass collides with a ~~the~~ tip of the displacement body, and the flow of melted mass is circularly distributed.

16. The die~~Die~~ head according to claim 2, wherein ~~one of claims 1 to 15, characterized in that the peripheral surface of the distribution element,~~

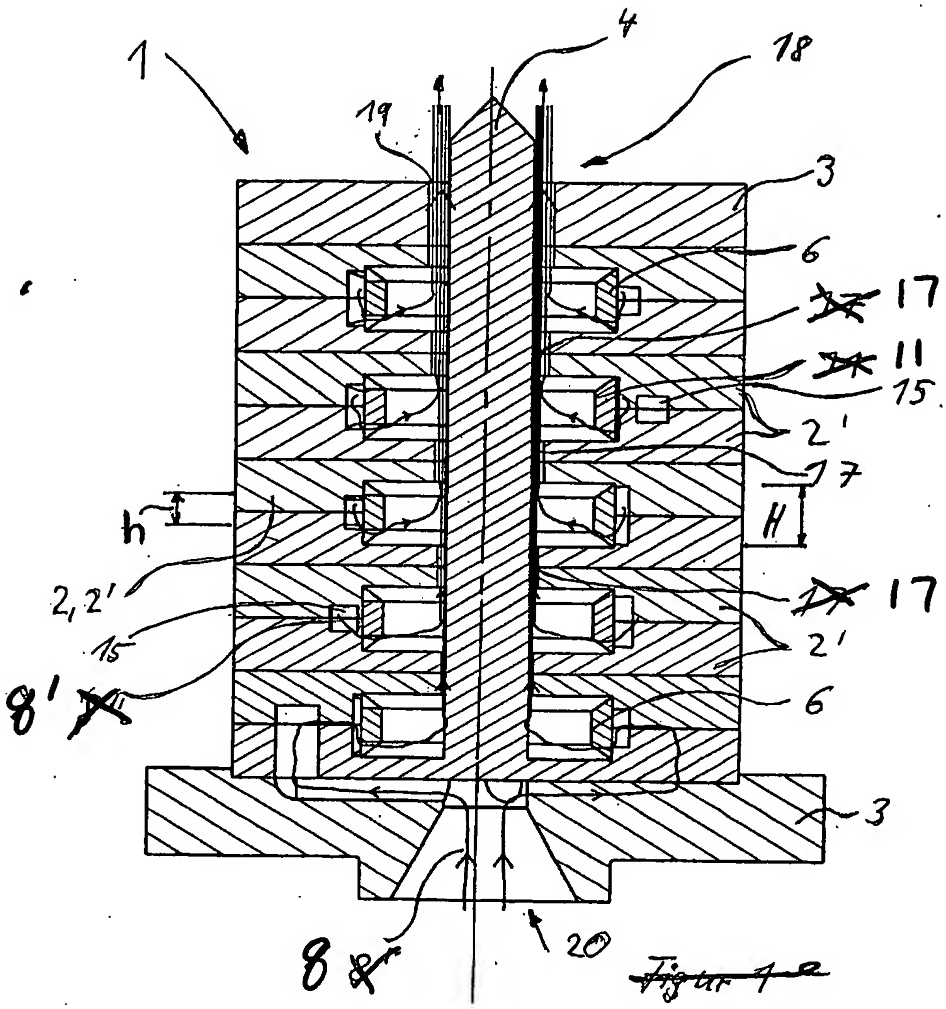
~~where~~ the tangential flow occurs at ~~occurs,~~ ~~is~~ an outer peripheral surface of the ~~said~~ distribution element.

17. The die~~Die~~ head according to claim 2, wherein ~~one of claims 1 to 16, characterized in that~~ the ~~peripheral surface of the distribution element, where the~~ tangential flow occurs at ~~occurs,~~ ~~is~~ an inner peripheral surface of the ~~said~~ distribution element.

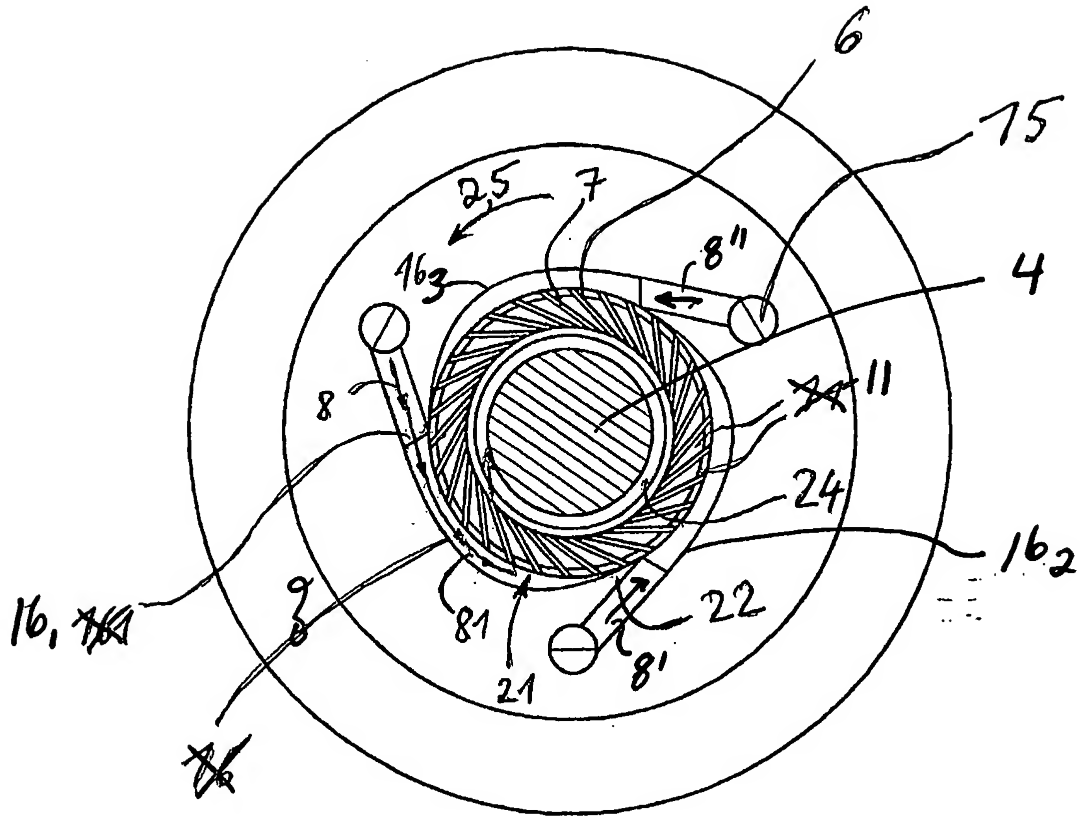
18. The die~~Die~~ head according to claim 1, wherein ~~one of claims 1 to 17, characterized in that~~ the distribution element ~~(6)~~ includes a plurality of lamellae ~~(11)~~ interspersed with orifices arranged such that an action of force occurs at an ~~the~~ exit of the orifices due to a material expansion of the melted mass.

ABSTRACT~~Abstract~~

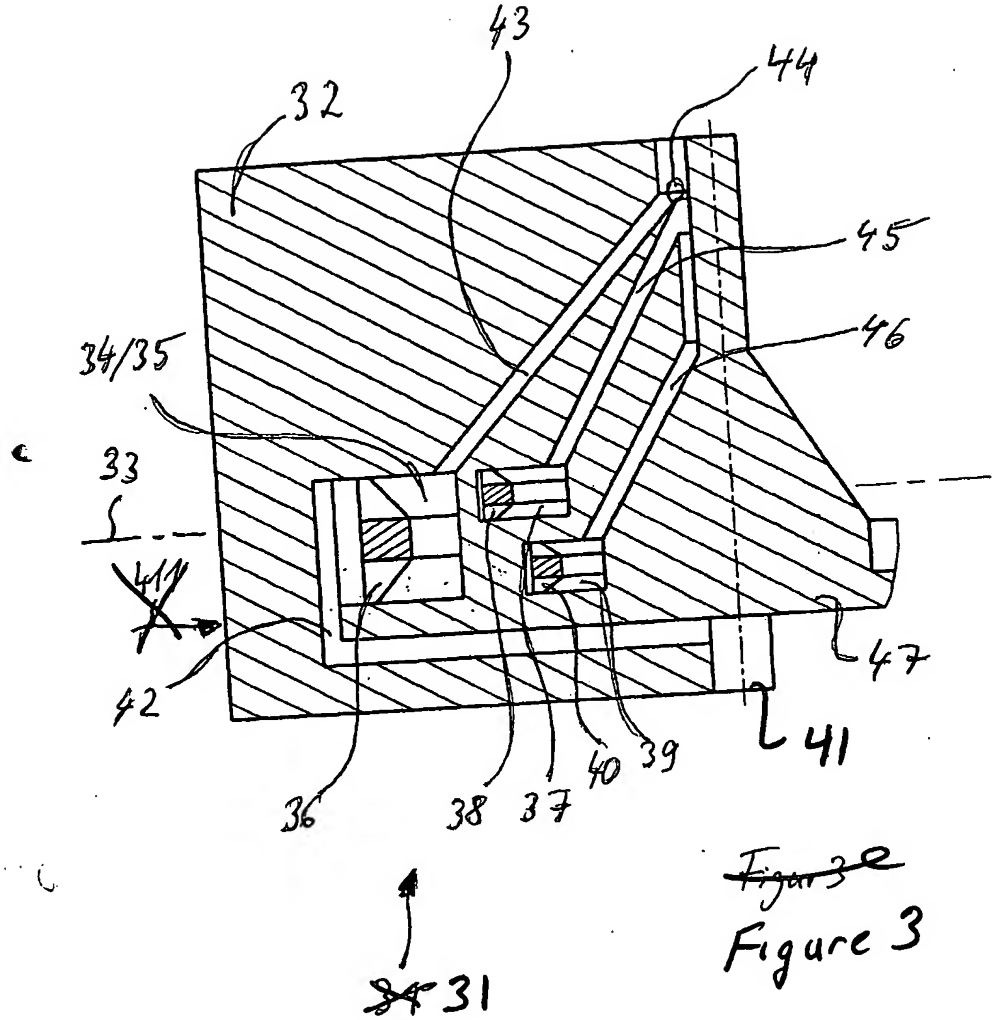
A~~The invention is directed to a~~ die head ~~(1)~~ for an extruder including ~~extruder,~~ ~~comprising~~ an outer shell, ~~shell (2),~~ an inner cylindrical mandrel, ~~mandrel (4),~~ an annular die gap at a discharge side of the die head, ~~(19) located on an outlet side,~~ at least one intake opening for receiving a ~~supplying the~~ melted mass, at least one distribution element ~~(6)~~ for distributing the melted mass to ~~in~~ a central ring channel terminating in ~~merging into~~ the die gap, an inflow channel connecting the at least one intake opening to the at least one distribution element. Further, at least one of ~~whereby~~ the distribution element and the ~~(6) and/or an~~ inflow channel ~~(16)~~ are formed such that the distribution element ~~(6)~~ is set into ~~in~~ torsional motion around a ~~the~~ longitudinal axis of the mandrel ~~(4)~~ due to an flow of the ~~inflow of~~ melted mass, and ~~that~~ the flow of melted mass is routed to ~~channeled into~~ the central ring channel.



~~Figur 1a~~
Figure 1



~~Figure~~
Figure 2



~~Figure 2~~
Figure 3

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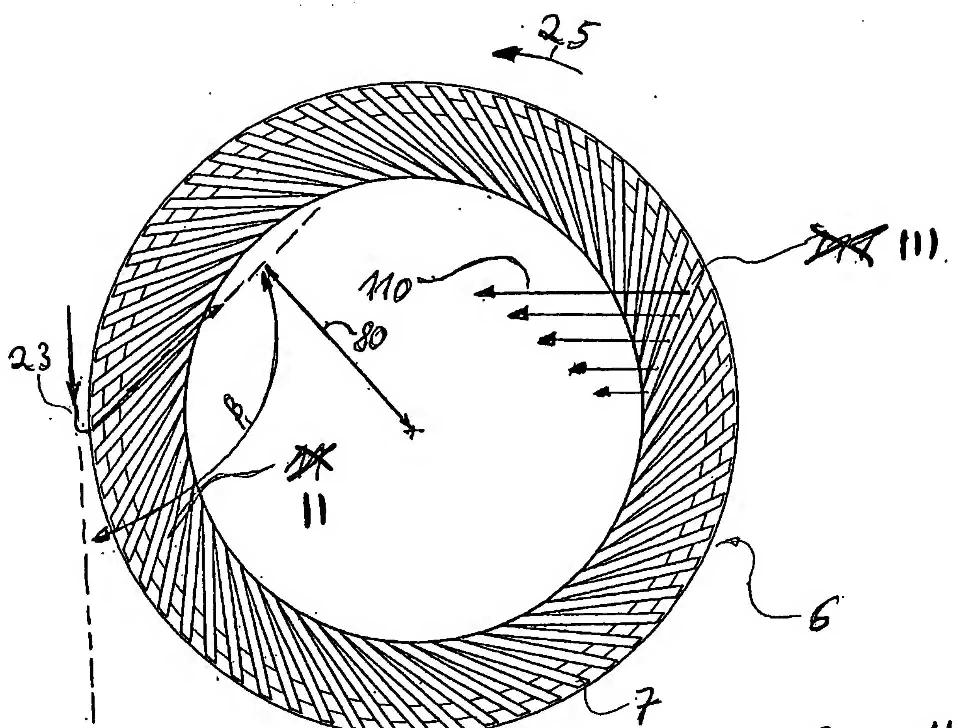
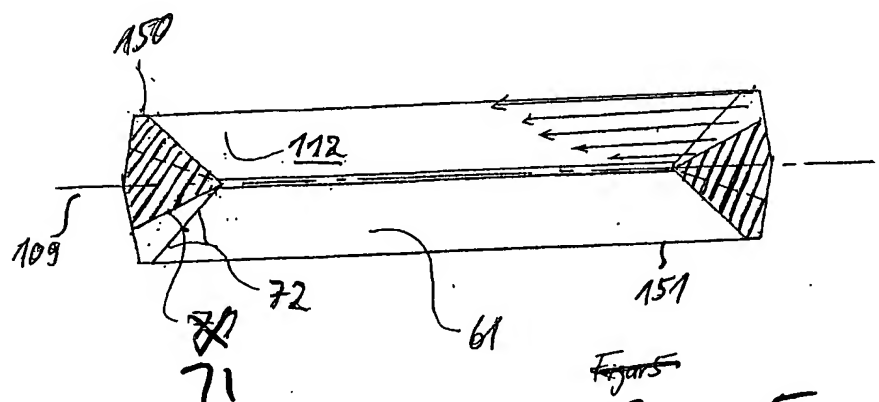


~~Figur 4~~ Figure 4



~~Figur 5~~ Figure 5

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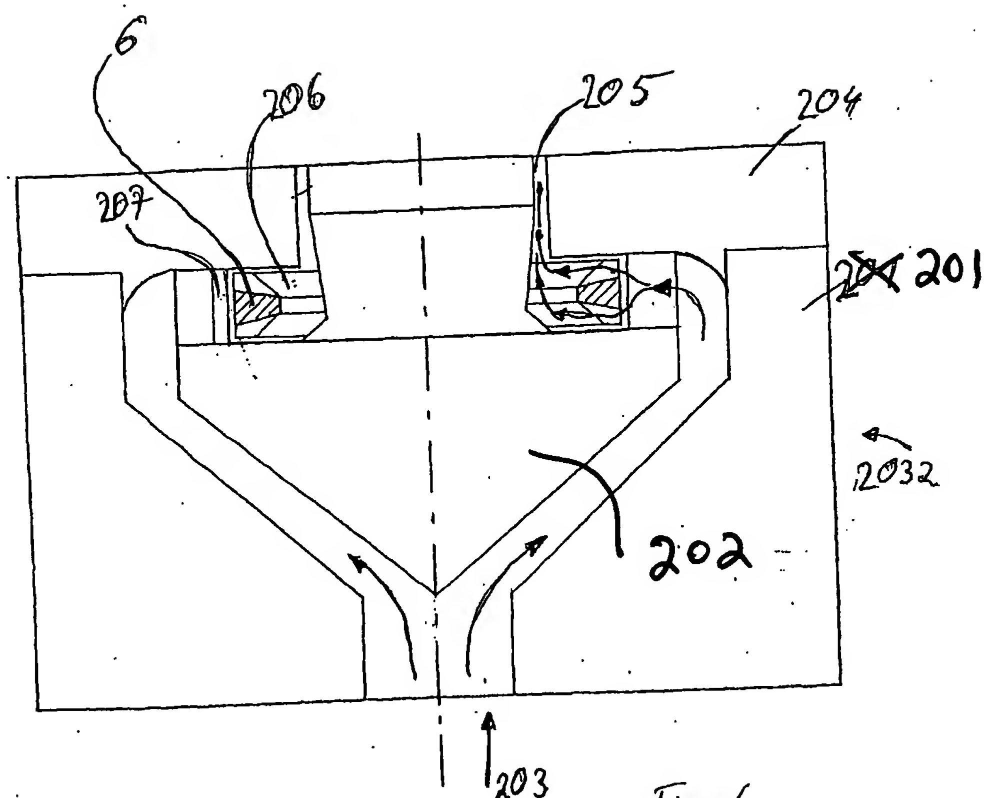

~~Figure 6~~
Figure 6